(Lengthy Technical Details for Readers who see beauty in Engineering Elegance!)

The LightGenie™ Technical Details

DESIGN SPECIFICATIONS

• The all solid-state LightGenie is designed for operation with:

Battery Voltage from 9 to 16 volts;

Continuous and **Simultaneous** operation, as needed, of:
- 10 Amps max. into power supply of HID, or incandescent low-beam headlights
- 12 Amps max. into incandescent upper-beam headlights
- 7.0 Amps max. into incandescent tail and associated lights (14 Amps max. on special request), and
- 7.0 Amps max. into incandescent dome and associated lights (14 Amps max. on special request), in ambient temperatures from –40 degrees C to +100 degrees C;

Continuous operation above +100 degrees C, up to +125 degrees C, if limited to low-beam headlights and tail lights alone, or just the DRLs, for a few hours a day, to preserve the long lifetime of the LightGenie.

• The LightGenie consumes a perfectly negligible current from the vehicle battery to perform all intended operations (3.5 mA in stand-by operation).

• The LightGenie uses about 800 KHz as the highest frequency within the vehicle electrical system, so it complies readily with Part 15 of FCC Rules without requiring formal tests and certification.

• In all operations, the LightGenie uses absolutely no additional switches other than the conventional switches of the vehicle.

• During installation and operation, the LightGenie provides self protection and protection for the energized circuits against:
- continuous overcurrents from a safe margin over the design currents to dead shorts
- continuous overvoltages from 19 to 28 Volts
- damage caused by disconnection from chassis ground
- damage by reversed battery polarities
- repeated load dump transients, inductive switching transients, alternator field decay, mutual coupling, electrostatic discharge, as well as humidity and splashes of liquids as detailed in Recommended Practice SAE J1211.

• A LightGenie automatically ID's, resets, and recalibrates itself during a battery change, with all the light switches in any position.

PATENT PROTECTION

• The LightGenie is protected by US Patents 5,329,204 and 5,621,277. Other Pat Pend.

HOW THE LIGHTGENIE WORKS

A LightGenie for OEMs or AfterMarket senses when the engine is running and when a certain light switch under its control is turned on or off without the need of a single wire to be connected directly to the ignition switch or to any of the light switches. It does these essential sensing tasks with patented and proprietary methods, making it possible to reduce the number of connections to any automotive wiring system to a strict minimum. It further reduces this number of connections by inserting electronic switches in series, anywhere in each circuit to be controlled (Hi-Beam Headlights; Low-Beam Headlights; Tail or Park and associated lights; Dome and associated lights); via a removed fuse; a removed circuit breaker; a removed power relay, and/or a removed dimmer relay. The LightGenie then acts as an intact fuse in series with a closed switch where and when it is to turn on the lights, and acts as a blown fuse where and when it is to turn them off. When and where it is to energize a set of lights at a luminous intensity lower than the design intensity such as in the DRLs, the series-insertion is pulse-width-modulated by the LightGenie with a preset duty cycle to comply with the regulations. The LightGenie senses every 25ms the preset threshold of ambient light between high and low levels by way of an infrared photo-transistor integrally connected to the LightGenie's circuit board with a Teflon-insulated pair of wires. This photo-transistor is installed to look upward toward the sky through a gap chosen within the vehicle's body. Whether the engine is running or not, the LightGenie monitors each energized circuits a few thousand times every second, and acts as a blown fuse only in the circuit where there is a short circuit or an overcurrent beyond the nominal design current, while continuing to energize other circuits which are still healthy. Every six seconds later, and for half a minute, the LightGenie interrogates the circuit at fault to see whether the fault is removed, while energizing and monitoring the remaining healthy circuits. If the fault is removed before this half minute, the LightGenie automatically will energize the revived circuit according to the state of the ambient light, the light switches, and the vehicle engine. Otherwise, the at-fault circuit will be shut down until the next ambient light change, the next manual light turn-on, or the next time the engine is started. At that time, the LightGenie will perform another half-minute check of the shut-down circuit if it is among the lights to be turned on; if the fault is removed, the circuit will be revived automatically. Any time, when the LightGenie sees an overvoltage while there is any circuit being energized, it will immediately shut down all circuits. If any circuit still needs to be energized if there were no overvoltage, the LightGenie will check every six seconds; if the danger of overvoltage is removed, it will restore the energizing automatically.

Activation of the LightGenie Operations

The LightGenie is designed to be ***user-friendly***. It is controlled with the same Main Light Switch with which users are familiar. With it, the users have ***intuitive*** access to several different operating modes:

• **40-Second Delay Turnoff:**

At night, when the user has finished driving and the running engine of the vehicle is stopped, the LightGenie may be ordered to keep the lights which are controlled by the Main Light Switch, at full intensity, illuminating the way for the vehicle

user while blinking briefly every second to reassure the user that it is working healthily. It then turns off these lights after 40 seconds automatically. ***This blinking is also the classy mark of elegance of a LightGenie user:*** It gently and clearly tells the good Samaritans out there not to waste their time and the user's time with the unnecessary warning about headlights left on inadvertently.

The semi-permanent selection of the 40-second delay turn-off is systematically done in a toggling fashion with the Main Light Switch, from the OFF position 3 times, in the sequence (OFF-HEAD), while the engine is not running. The LightGenie will blink the Head and Park lights 3 times then turn them off. Once a selection is made, it is remembered by the LightGenie and executed again and again flawlessly until toggled to the alternate selection, or overridden by an instant selection. In this instant selection, the user can activate a 40-second delay turn-off on a one-time basis – regardless of the pre-selected mode of delay turn-off – any time before the engine is stopped at night, by actuating the Main Light Switch from the OFF to the HEAD position. Also, an unwanted 40-second delay turn-off can be suppressed instantly by the user before or after the engine is stopped by simply turning the Main Light Switch from the HEAD to the OFF position. The LightGenie for OEMs will automatically turn on the DRLs for all, or the legal evening driving lights for many units, when the engine is started and run again while the Main Light Switch is in the OFF position. With no exception, the LightGenie will automatically do so for all OEMs and AfterMarket units while the Main Light Switch is in the HEAD position.

• **4-Minute Delay Turnoff:**

While the vehicle engine is stopped, and ***without the need of an ignition key***, turning the Main Light Switch from OFF to on (PARK or HEAD) will cause the lights which are controlled by the light switch to be turned on continuously for 4 minutes and then turned off automatically. This operation can be repeated (until the end of usable energy in the battery if necessary), for 4 minutes at a time, by turning off the light switch then on again while the engine is still not running. This battery-saving feature is unique to the LightGenie at the present time, and adds to the peace of mind for the user about day-to-day hazards of lights left on or turned on by unknowing people, such as kids in the family.

• **4-Hour Automatic Park Lights:**

This feature is very useful in Europe where vehicles parked in narrow streets need to be visible. While the vehicle engine is stopped, turning the Main Light Switch from the OFF position in the sequence (OFF-HEAD)(OFF-HEAD) activates a bonus safety feature that only the LightGenie offers: it blinks the Headlights and Park (or Tail) lights twice, and turns on only the Park and associated lights for 4 whole hours in a continuous, low-intensity manner; it then turns them off automatically while saving plenty of energy for restarting the engine (if the ambient temperature is not colder than zero degree F). The user can repeat this operation twice without fear of not being able to restart the engine, if the weather is warmer and the battery is relatively new and well charged. This safety feature can be used when the vehicle is parked in a dark area where it needs to be visible from a far distance without any powerful light shining on it. For that purpose it is better than the conventional hazard flasher (that still can be used at any time) which would drain the battery to unusable conditions after about two to three hours of operation.

The successful activation of this mode of operation serves also as a post-installation test to confirm that the installation is free of any gross misconnections, and probably done correctly in every respect.

• **Daytime Running Lights:**

The Main Light Switch may be in the OFF or HEAD positions to activate the automatic Evening Driving Lights, Daytime Running Lights and Raintime Running Lights with the LightGenie for OEMs. Whenever the vehicle engine is running, the head and tail lights will be continuously on in the conventional way, when the ambient light level is low or when it rains, making ambient light lower than daylight. When the engine runs and when the ambient light level is high, on vehicles permissible by regulations, the LightGenie automatically turns on only the upper-beam headlights at a luminous intensity of about 1400 candela as intended Daytime Running Lamps (DRLs) and turns off the tail and associated lights to minimize gasoline consumption and maximize the life of the light bulbs of the headlights and tail lights in the most desirable manner. In less optimal cases dictated by regulations or wiring architecture, the LightGenie automatically turns on only the incandescent low-beam headlights as intended Daytime Running Lights (at a voltage equivalent to about 87% of design voltage for Canada, or providing a luminous intensity of about 1400 candela for US), and turns off the tail and associated lights to minimize gasoline consumption and maximize the life of the light bulbs of the head and tail lights.

To comply fully with the present regulations, the LightGenie for the Canadian market will have the DRLs coming on automatically every time the engine runs, day or night, when the Main Light Switch is put intentionally or inadvertently in the OFF position, or in the PARK position during daytime, and the Safety Brake is released. While designed in close consultation with the NHTSA to be in full compliance with US Standard 108, especially regarding the DRLs, the LightGenie for the US market will offer an ultimate feature that will eliminate what has prevented a few people from enjoying fully the DRLs up until now. To harmonize with the Canadian practice, the LightGenie for the US market will turn on automatically the correct lights, day or night, when the Main

Light Switch is in the OFF position, as soon as the engine is made to run. However, after the engine is made to run, and after the Main Light Switch is in the HEAD position — being there usually in day-to-day driving, at the time the engine starts to run, or moved there from the OFF position intentionally — any subsequent moving of the Main Light Switch to the OFF position will immediately shut off all the head and tail lights, including the headlights serving the function of DRLs. Subsequently, at the discretion of the driver or without any further intervention from the driver, the DRLs or Night Driving Lights are designed to come back on correctly as soon as the Main Light Switch is moved away from this last OFF position; or the ambient light changes from day to night or vice versa; or the engine is stopped and restarted to run again. This feature, as well as the no-glare level of DRL luminous intensity, has been designed into the LightGenie for OEMs in anticipation of the US ***public strong reaction to the lack of driver's control of the DRLs and the excessive glare*** of some type of present DRLs. This ultimate safety feature may save a few heart attacks or bodily harms by hoodlums when a user wishes to dash through a perceived zone of danger in the most inconspicuous manner possible. This feature also makes the LightGenie ideal for US users doing investigative work of any nature. It will make the US LightGenie qualify automatically, without any further changes, for a limited Canadian market of vehicles which are approved to have an official waiver for investigative work, especially police work.

During daytime, the Flash-to-Pass (FTP) would be operational at every position of the Main Light Switch; the Funeral Lighting mode (head and tail lights on) would be activated by moving the Main Light Switch from the OFF to the HEAD positYon and left there for automatic turnoff when the engine is shut off, or can be turned off any time by moving the Main Light Switch from the HEAD to the OFF position.

• **Semi-permanently activated or deactivated DRLs:**

To offer to the OEMs the best flexibility in satisfying the greatest number of customers possible, the US LightGenie has a built-in feature that provides the users of the LightGenie-equipped vehicles with the instant choice of activating or deactivating the US type of no-glare, already-obedient DRLs in a semipermanent manner according to seasonal, regional or personal-opinion changes.

The LightGenie comes initially with DRLs activated when first plugged in and powered by the vehicle battery. Any time later, the alternate state of DRLs can be set by the user in a toggling fashion by operating the Main Light Switch from the OFF position 4 times, in the sequence (OFF-HEAD), during the time when the engine is not running. This operation will blink the Head and Tail lights 4 times and then turn them off. The chosen state of DRLs remains the same until the user changes it to the other alternate state; or until the vehicle battery is down to less than 4 volts and charged up to above 9 volts again. In the last instance, the DRLs revert to the initial state. When activated, the DRLs and every other automatic features of the LightGenie operate as described previously without the users having to do anything with the Main Light Switch, day or night. However, when the DRLs are deactivated, every operation of the LightGenie would be automatic when the engine is or is not running, except that when the engine runs during daytime there would be no DRLs; the bonus FTP would be operational at every position of the Main Light Switch during night or day time; the Funeral Lighting mode would still be activated the same way as described before; and the position of the Main Light Switch, left unchanged in the OFF or HEAD position since the start of any engine run, would keep off all the head and tail lights. In the evening, it then turns on all head and tail lights for driving and turns them off with or without delay, when the engine is stopped. During daytime, the DRLs are always turned off immediately when the engine is stopped.

• **Semi-permanently activated or deactivated Fog-and-only-Park-lights-on mode**

The OEM and aftermarket LightGenies now can serve the users of vehicles with Fog lights with the unprecedented convenience of leaving the Fog-Light Switch in the FOG ON position along with the Main Light Switch (MLS) in the HEAD position all the time: During the day, only Headlights are on at correct lower intensity as Daytime Running Lights when activated, or off when deactivated. At night, the Fog lights will come on along with the Headlight low beams and the Park lights until the time when the driving is done, and then all will turn off automatically with or without delay at user's choice. Beyond this unprecedented convenience, the LightGenies add a bonus second Fog lights mode to these vehicles. This is the Fog-and-only-Park-lights-on mode in the evening that many users prefer around the world, especially in some parts of the US, as it gives better visibility in front of the vehicle in many foggy conditions. This bonus mode is magically provided by the LightGenies to the users, ***without any wire circuit change whatsoever, even on vehicles which could not provide it in the original wiring architecture.*** The LightGenie for a vehicle with Fog lights initially will provide the first Fog-lights mode as described above, when installed. The user can choose the second Fog-lights mode in a semi-permanent manner, any time, by making sure that the engine is not running and actuating the MLS from the OFF position 5 times in the sequence (OFF-HEAD); each step following the other within 1.5 seconds in a leasurely fashion. The LightGenie will blink the Head and Park lights 5 times then turn them off. With the MLS now in the HEAD position, the selection of the mode can be verified

by turning the Fog switch to the FOG ON position and starting the engine. The area where the light sensor is located can be covered or uncovered to simulate night or day to observe the two related exterior lighting modes; and then the engine can be shut off for all the lights to turn off with or without delay as preselected by the user before. Subsequently, any time during driving at night, the first Fog-lights mode can be selected on a one-time basis by moving the MLS from the OFF to the HEAD position in a fraction of a second. To reselect the first Fog-lights mode in a semi-permanent manner, the above sequence of (OFF-HEAD) can be executed 5 times again leasurely while the engine is not running.
The semipermanent programming of Fog lights control may be determined otherwise by OEM.

• Battery-Rundown Protection:

Except for the conventional hazard flasher circuit, the LightGenie insures the user with automatic turnoff of all vehicle headlights, tail and associated lights, and dome and associated lights. The LightGenie provides day-to-day absolute peace of mind concerning aggravating battery rundown that requires jump starting. OEMs can see easily how much will be the 'automatic' savings in roadside assistance, as well as the profitable aspect of increasing the driving pleasure for the customers.

LightGenie users are insured with virtually absolute battery protection while enjoying the safety of the automatic Night Driving Lights with or without Delayed Turnoff, Daytime Running Lights (DRLs) and Raintime Running Lights (RRLs). RRLs are currently required in some states. One of the LightGenie's obvious advantages is that a user never has to remember to turn on and off the required driving lights each evening, as in vehicles equipped with other kinds of DRLs.

• LightGenie's user-friendliness

During and after any delay turnoff operation, when the engine of a vehicle equipped with a LightGenie is made to run, all the involved lights automatically revert to being continuously on in the conventional way, as DRLs or Night Driving Lights. At any critical time whatsoever, namely, when the vehicle engine is running or not running, day or night, a vehicle user in the US will always have the ***absolute control as to when a certain light has to be on or off immediately*** with the familiar and intuitive manipulation of the light switches. Thus, the users would not feel condemned with a light system that stays on at the wrong time against their will. The switch-over from one to another operation of the LightGenie is natural and fast: turning the Main Light Switch to OFF to cut short immediately an unwanted operation or to reset the LightGenie, then, after half a second, leisurely activating the wanted operation and the LightGenie will oblige.

• Great Benefits to OEM:

Installing a LightGenie for OEMs on any chosen vehicle is extremely easy and fast. It requires absolutely ***no cutting or splicing of any wire, requires no drilling of any holes*** whatsoever. It can be done safely without disconnecting a vehicle's battery cable. Installation simply consists of:

• Making sure that all lighting circuits of the vehicle are in good working condition; (*all light switches may be in any position*);

• Attaching the LightGenie's bracket onto the chassis under the hood (or in the instrumentation panel area) by way of a designated bolt, nut, or U-shaped spring;

• Either, plugging a single 8 or 10-prong plug coming from the LightGenie into a designated group of fuse sockets in the Underhood Power Distribution Box (UPDB) or the Instrumentation Panel Fuse Box (IPFB);

• Or, plugging 2 or 3 relay-looking plugs and 1 or 2 fuse-looking plugs coming from the LightGenie into designated sockets in the Underhood Power Distribution Box (UPDB), or in the Instrumentation Panel Fusebox (IPFB).

• Closing the cover of the UPDB or the IPFB; and finally

• Installing the light-sensing phototransistor in a noncritical manner within a pre-selected gap in the body of the vehicle.

As long as the plug-in area is readily accessible, the whole installation can be done in ***less than 1 minute*** in a foolproof manner at the assembly line, show room or elsewhere. Mistakes at any stage of the installation would not harm the vehicle wiring or the LightGenie, and would be pointed out during the post-installation tests. During operations after installation, the LightGenie monitors itself vigilantly and can point out either it is malfunctioning or there is a short or overcurrent in the wiring of the circuit it controls. Corrective maintenance can then be done similarly to that of a resetable circuit breaker. No routine maintenance is necessary.

• Re-extractable Fault Report:

To maximize the safety for users, the LightGenie is designed to memorize and report to the user or service people about the healthiness of its operations and of the circuits under its control.

When a fault happens to the wiring under the control of the LightGenie, for example after a collision of the vehicle, the LightGenie would blink notably slow, once every 2 seconds, for 80 seconds, then turn off all the lights after the running engine is stopped. The LightGenie does this regardless of whether the Main Light Switch is in the HEAD or OFF position and regardless of whether the 40 second delay turn-off was activated or deactivated. It means the LightGenie tries faithfully to report to the user that it saw a short circuit or an overcurrent in at least one of the four circuits of Hi-Beam, Lo-Beam,Tail, or Dome lights, any time before the engine was shut off. It could also mean that one of the LightGenie's electronic relays, like any practical device, has

failed randomly in its inherent, although low, failure rate when operated within the rated conditions. This report can be re-extracted by turning the Dome Switch on, the Main Light Switch (MLS) from OFF to HEAD (HD), and blinking the Dimmer Switch to observe which of the lights can not go on. Immediate service can be evaluated.

In extremely rare occasions when the engine is shut off after driving, day or night, the lights may stay on longer than 40 seconds; or, the exterior lights remain off when the engine is started and run when they are intended to be on. It means the ignition sensor of the LightGenie, like any practical device, has failed in its inherent, although very low, failure rate when operated within the rated conditions. This is to report to the user that this occasion, however rare, happens as a natural random fault, and that the LightGenie needs the user's help to manually turn off all head and tail lights after the engine is stopped, and to turn them on when necessary, day or night, because at this point, it cannot recognize when the engine is shut off or running any more. As long as the computer on the LightGenie does not fail in its inherent, known as excessively low, failure rate when operated within the rated conditions, it is programmed to smartly recognize the difference between the abovementioned failure of the ignition sensor and the absence of the running engine ignition, and thus to dutifully keep the driving lights on for the safety of the driver, even if such failure of the ignition sensor happens in the middle of a driving session. This report can be confirmed by turning the MLS from OFF to HD and seeing the Head and Park Lights go on for 1.5 sec., off for 1.5 sec., then on again until the MLS is in OFF again. This assures that the vehicle can still be used until the earliest chance of replacing the defective LightGenie.

Another rare eventuality is when the engine is shut off, all the driving lights stay on beyond 40 seconds. It means that the LightGenie needs the help of the user to manually turn off all those lights, and to turn them on when necessary. It is to report that there is on the vehicle either an aftermarket device that produces strange disturbances in the battery voltage similarly identified as the ignition of the running engine; or an unusually corroded contact on the power connector of one of the Head or Park lamps which could not be simulated during development for the LightGenie to learn to recognize; or a unique LightGenie failure never observed previously. This report can be confirmed by turning the MLS from OFF to HD and observing that the Head and Park Lights go on continuously until the MLS is in OFF again. Like the last case, this assures that the vehicle can still be used as if there were no LightGenie attached. It is best, however, to service the vehicle at a repair facility to identify the cause of the failure. If the LightGenie is indeed at fault, then replacing the damaged unit with a new one will restore all features and benefits for the user. However, if the cause of the problem is an aftermarket device in conflict with the LightGenie, then the user is free to return the LightGenie for a full refund to continue using the other device.

As a courtesy to enhance the safety of the driver, the LightGenie monitors the ambient temperature constantly around itself. Normally this temperature would not reach 125 degrees C. However, in the unusual situation when the temperature reaches 130 degrees C because of engine overheating or an unkown malfunctioning of the LightGenie, the Head, Tail, and Instrumentation lights will lower themselves slightly for a second repeatedly every two seconds--still safe for the front visibility of the vehicle but noticible enough--to warn the driver to stop the vehicle safely to check and take appropriate actions.

Finally, in the exceedingly rare probability that one of the electronic relays or the microcomputer of the LightGenie fails in the mode that keeps one or more exterior lights on, regardless of what is done to the MLS, roadside assistance or shop service can unplug the LightGenie and replace it with the original relays/fuses or another new LightGenie in a few minutes.

• **Instant De-installation:**

To isolate a fault reported by the LightGenie, the main plug of the Universal LightGenie can be removed safely while the engine of the vehicle is not running and all the light switches (except, if necessary, the Dome light switch) are in the OFF position. The fault finding related to the circuits controlled by the LightGenie can be done very quickly and easily with a VOM and a pigtail, or a shorted-wire detector like in the good old days.

VEHICLE WIRING REQUIREMENTS

The LightGenie for OEMs (also called the Universal LightGenie or simply the LightGenie in this document) has been refined countless times to assist the OEM vehicle wiring engineers to quickly obtain the solution to all auto lighting problems resulting in the best performance and lowest cost possible. The LightGenie's tremendous assistance to the wiring engineers can be elucidated by the use of the diagrams CONFIG. A, CONFIG. A1, CONFIG. B, CONFIG. B1, and CONFIG. C1, along with photos of the Universal LightGenie in **four** main variations in FIG. 1, 2, and 3 on pages 18 to 20. These variations can be demonstrated to allow the wirings of all presently manufactured vehicles to be ***simplified*** quickly to accept instantly the LightGenie in a systematic and profitable manner.

• **Configurations A and A1:**

Referring to CONFIG. A and taking into account the fact that all the wires connected to the right side of F1, F2, F3, and F4 need to carry only less than 1 mA to work with the LightGenie, one can see easily that ***every single vehicle in production*** (including those using power relays because of the low-current nature of their light switch system) can now

have the wiring reduced to this simplest, and yet very safe form to enjoy the great majority of benefits of the LightGenie. CONFIG A requires the simplest Dimmer Switch, and yet, with its proprietary processing, the LightGenie would provide the OEMs with the best FTP as a bonus.

For ***OEM vehicles having FTP*** already built into the light switch system, CONFIG A1 will reduce further, by one wire, the wiring changes to get the vehicle ready for the LightGenie.

For ***OEM vehicles having already a Generic Electronic Module (GEM) or some form of battery saver*** that controls the Dome and associated lights, fuse socket F1 can be other than the one built in for the Dome lights, and the required wiring for the LightGenie will be further reduced by another wire.

Thus, the wiring of the majority, if not all the newly designed vehicles of an OEM can be quickly, easily and profitably reduced to these simplest, yet proven very safe configurations to immediately enjoy the benefits of the LightGenie ***without sacrificing*** anything in the ***wiring safety*** of those vehicles. ***The OEMs will save a large amount of materials, design time, and installation labor***. The LightGenie would be connected to these configurations with an 8-prong single plug inserted into the emptied sockets of fuses F1, F2, F3 and F4 which are prearranged to be ***located consecutively in a row***. Even in these simplest configurations, ***exactly the same for everywhere in the world***, the different firmware and hardware variations of the LightGenie will provide:

1. Absolute, carefree, security of mind for users concerning battery rundown that requires aggravating jump starting;

2. Classy, automatic Evening Driving Lights ***with*** or ***without*** delayed turnoff, selectable instantly by the user in day-to-day driving;

3. Bonus Flash-To-Pass, day or night, in every position of the Main Light Switch, with daytime smart feature that, at OEMs choice, turns off automatically the upper beams after two seconds if the dimmer switch is inadvertently latched in upper beams;

4. Factory choice of 2-lamp or 4-lamp headlights, with or without contributing low-beams in upper-beams selection by the dimmer switch;

5. Turning on the Parking lamps at about 30% of design power for 4 hours, and turning them off automatically. This feature is valuable in many countries other than the US;

6. For the **US** and countries permitting DRLs similar to the US, automatic DRLs with factory choice of upper-beam or low-beam type at ***no-glare*** luminous intensity; absolute, instant control for users on when DRLs or Evening Driving Lights have to be off; smart Flash-To-Pass at every position of the Main Light Switch, day or night;

7. For the **US,** a **DRL** system that can be ***activated*** or ***deactivated*** any time in a ***semipermanent*** manner simply and instantly by users when desirable, to reserve the absolute rights and means for the users in experimenting with DRLs or not, while preserving for their safety and pleasure, all other proven beneficial features of the LightGenie;

8. For the **US**, universally set light sensing that turns on evening and rain-time legal lights at ambient light a little higher than the popularly accepted threshold level, in order to make sure that even when users deactivate the DRLs by choice, when it begins to rain during daytime, the natural slightly lower ambient light would be enough to automatically turn on the rain-time legal lights in those States that presently mandate them;

9. For marketing purposes or for any ***future*** State of the US where the rain-time regulation may mandate that ***new vehicle manufacturers*** provide automatic headlight turn-on as soon as the windshield wipers are activated if there are no DRLs (no such State regulation yet at the present time; only regulation that mandates that ***users*** turn on headlights when weather conditions require the use of windshield wipers, in a few States), provision of ***absolute compliance*** with this regulation by accepting one input from OEMs wirings going into the left side of fuse F5 socket, preferably +5V to +16V, less than 1mA, when the windshield wipers switch is on, and ground or off-ground when they are off; this input being simply processed by the LightGenie as a secondary light sensing input that says 'evening time' when the windshield wipers switch is on (a ground-active input for this purpose can also be accommodated);

10. For countries which do not allow DRLs, a system which has all the automatic and bonus features, except no DRLs and no possible activation of DRLs by any means;

11. For Canada and countries requiring similar DRLs, automatic DRLs with factory choice of upper-beam or low-beam type at any ***no-glare*** luminous intensity permitted; Flash-To-Pass at every position of the Main Light Switch; but, by Canadian laws, no provisions for users to turn off the DRLs, day or night, at any time when the engine is running, except at the moment when the engine is started and the Safety Brake is still engaged.

This last compliance with the Canadian Regulations requires fuse socket F5, located anywhere in the same fuse box containing the group F1 to F4, to be supplied by the OEMs in order for the LightGenie to have the information about the state of the Safety-Brake release. This compliance is to allow mainly the vehicle maintenance people in Canada to turn off the DRLs while working in front of a vehicle with the engine

running. For the same purpose, the LightGenie for US and similar countries saves the OEMs the cost involving the supply of the Safety-Brake information by advising the maintenance people simply to turn the Main Light Switch from the HEAD position to the OFF position for all headlights and parklights to be off.

Wiring in configurations A and A1 may empower the whole group of aforementioned vehicles of OEMs in having one extra desirable item in the premium option package for countries other than Canada. If all the wires, fuses and switches in this configuration are properly sized according to industry practice, a vehicle wired this way can be marketed directly as a base model, as exactly done very often at the present time. It will have nothing automatic in the control of different groups of lights; no DRLs; no Flash-To-Pass (FTP) (in configuration A), or good, but basic FTP (in configuration A1 in any position of the Main Light Switch). The headlights could be of the low-beam contributing or non-contributing type. At the factory, the new car showroom or the user parking lot later on, the **LightGenie** can be installed in a foolproof manner to perform and to look as perfect as a genuine factory-installed option, with all the intuitive, elegant, automatic and safer features that many busy drivers can only dream about up until now. Beyond the absolute security of mind about not having to ever miss an important appointment because of a battery rundown, and the pleasure of not having to bother with the Main Light Switch when driving and leaving the vehicle in day-to-day operations, the adopters of the **LightGenie** would enjoy its unique refinements to feel absolutely free and relaxed in experimenting with the improved no-glare DRLs for their own and others' safety.

• Configurations B and B1:

Two groups of OEMs items may be optionally added to the simplest CONFIG. A and CONFIG. A1 to provide the OEMs with the total package of benefits of the LightGenie.

When the line to the right-side point of fuse socket F5 in this CONFIG. B or B1 is connected longer than 25 milliseconds to a voltage of +5V to +16V providing just about 1 mA, the LightGenie will immediately flash the Headlight low-beams and the Parklights in an attention-grabbing manner at two cycles per second (and can not be turned off by the Main Light Switch), as long as that voltage is maintained. As soon as that voltage drops to zero volt or goes off ground, the LightGenie will go automatically to the task it is supposed to do at the moment dictated by the different switches, the engine state, and the ambient light. This feature is for OEMs applications in Vehicle Theft Security System, Panic Button, Power Door Lock, etc... without ***having to add extra costly power relays and wirings*** as in the practice, up until now. A ground-active input for this purpose can also be accommodated.

Optional fog light control consisting of F8, F9, REL1 and Fog Switch may be added for Fog lights to be turned off automatically by the LightGenie with the Parklights, when the Fog light switch is left in the ON position all the time. This most economical hookup will provide the best system for Fog lights at the present time. It allows the Fog lights to be turned on by the Fog light switch only when the vehicle Parklights are on alone or with the low-beam Headlights, but not when the upper-beam Headlights are on, or when the DRLs are on.

Fuses F6, F7, F10, and F11 are individually optional. They can be added there by OEMs for better fault traceability in case the vehicle body is damaged badly at several places.

• Configuration C1:

In this configuration, the LightGenie depicts its guarantee to offer also to OEMs the instant factory-approved options of ***absolutely automatic light controls*** (as complete as described for configurations A, A1, B, and B1) for the vehicles that already use power relays in head and tail lights circuits at the present time, *requiring, in the majority of situations,* ***no change*** *in the present wirings* ***and instantly qualifying for the US, Canadian, and other standards.*** The great number of ways those relays are used would be accommodated easily by a great number of variations in the plugs that a single versatile LightGenie would be equipped for different OEM variations in order for the tasks to be accomplished correctly and safely in compliance with different regulations. Even in the most challenging variation (depicted by Fig. 3) where a single headlight relay energizes both the low beams and/or the upper beams which are selected by a mechanical dimmer switch, the Universal LightGenie still can detect remotely the very instant when low beams or upper beams of the headlights are selected. Normally, this variation of the LightGenie would use the low beam headlights as DRLs for OEM convenience, with regulation-compliant luminous intensity. In daytime driving, if the upper beams are latched on inadvertently longer than 2 seconds, this variation of the LightGenie will get as smart as the other two variations: It will immediately lower the luminous intensity of the DRLs to comply with regulations, as long as the upper beams are latched on. When low beams are re-selected, it will revert back to low-beam-DRL luminous intensity for DRL effectiveness.

A new vehicle equipped with **High-Intensity-Discharge** (HID) Headlights can also benefit from all the LightGenie's features with one of the variations of the Universal LightGenie found on Figs. 1 or 2.

• "Secrets" of LightGenie Revealed:

To appreciate how the LightGenie can do these acrobatic tasks flawlessly, one can picture the LightGenie as an aggregation of ***four*** electronic power relays; each one with its own smart, automatic, protection against short circuits, overcurrents, overvoltage; all powered by a +12v bus and controlled by a smart microcomputer equipped with ***"wireless"***

sensors for all light switches, ambient light, and engine run state. One of these electronic relays is dedicated to controlling the Dome and related lights; the remaining three are further adorned with power modulators and dedicated to controlling the Park Lights (Tail and associated lights), the Headlight low beams and the Headlight upper beams.

In all CONFIGs. A, A1, B, B1 and C1, the LightGenie is given the necessary connections to energize or de-energize, in whatever manner, all ***four*** groups of lights ***independently*** of the Main Light Switch. The commands to turn on the Dome and associated lights come from any of the Dome-related electronic or mechanical switches that puts a non-minimum current draw on the left side of F1. The information about the position of the Main Light Switch, the Dimmer Switch, the Safety Brake and whether to flash or not to flash are simply provided to the LightGenie by the lines connected to the socket of F5 and to the right side of F4, F3 and F2 in CONFIGs. A, A1, B, and B1; or by the former control lines used by the Body Control Module (or the built-in Light Switch System) to actuate the relays that energized the low beams or upper beams of the Headlights and the Parklights, in CONFIG. C1. In this last CONFIG. C1, the Body Control Module continues to make use of its own original Main Light Switch and Dimmer Switch and conveys freely to the LightGenie the info about the Safety Brake, which it surely has in store. Each of the three Head and Park lines going into the right side of the LightGenie Plug-in Area can be individually either +5V to +16V-level active, or ground-level active, as long as it is consistent and known beforehand to the LightGenie .

Ideally, F1 should not have any Ignition-Off-Draw current, so that when the LightGenie does the eventual most important task of saving the driver from a battery rundown, it would not erase the memory of anything such as the Radio Clock and preset stations. To extend further courtesy to the Body Control Modules (BCM) which are already 'very' hardwired to the Dome fuse F1 but yet still leave some of the Dome related lights unprotected from battery rundown disaster, the LightGenie will take upon itself to shoulder the task of supplying diligently the Ignition-Off-Draw current used by the Body Control Modules in all modes of operation; at the same time, it handles the extra task of preventing a battery rundown by turning off everything powered by F1 if a load on F1 is left on longer than 40 minutes while the engine is not running. This kind of load can be an unprotected Dome light left on inadvertently when the vehicle is parked unattended for a long time; or a door left ajar; or a trunk-light or underhood-light switch going bad. In this less than ideal case, anything under the supervision of the BCM such as the Radio Clock, Power Door Lock/Unlock, Dome-Lights-On when door is opened, etc... will be temporarily disabled until the time when the engine is started again or when the MLS is manually turned from OFF to Park or HEAD then to OFF again. If the Dome lights are seen as left on inadvertently, then manually turning them off would avoid another turn off (with BCM or not) after 40 minutes.

SUMMARY of Requirements for wirings of new vehicles to be LightGenie-ready for Canada, U.S. and other countries

The LightGenie has been invented and improved countless times, with the ultimate goal of offering the OEMs a product of the highest performance and lowest cost, while meeting or surpassing the numerous requirements for acceptance which are stringent, tyrannical and often brutal. Some aspects of high performance of the LightGenie are its practically indestructible solid-state construction; its inclusion of all components into a single package to be installed in a single bay of a vehicle; its automatic control and protection of Headlight Low Beams, Headlight High Beams, Park lights and Dome lights; its automatic turning on the DRLs and turning off all other lights including the Fog lights during the day when the users are in the habit of driving with Fog lights in the evening and like to leave the Fog-light switch ON along with the Main Light Switch in the HD position all the time, day or night; its automatic turning on the evening lights during driving and turning them off when driving is done, with or without a selectable 40-second delay-turn-off in the OFF or HD position of the Main Light Switch; its allowing the U.S. users to toggle between activating and deactivating instantly the DRLs for a whole season, for example, until the other option of the toggling is desirable; its intuitive activation/deactivation of all exterior lights and options with just the familiar Main Light Switch; and finally, its single wiring schemes for a new vehicle to enjoy the benefits of the LightGenie and to comply with regulations of any country in the world are ***astonishingly simple***. They are so simple that on many new vehicles in production now, with nothing automatic and no DRLs of any kind, complying only with U.S. type of regulations, a **single** additional wire linking the safety-brake-release switch and the designated relay and fuse box would make it absolutely ready to comply with any regulations, including the Canadian Standard 108 which requires very specific DRLs.

The wiring requirement for a new vehicle to be favorable to the LightGenie for the total performance package may be considered in three separate groups which use **four** main variations of the Universal LightGenie and their hybrids. First, for the group of vehicles being designed from concepts, the most profitable scheme of basic wiring would be the ones patterned after CONFIGs. A or B. Next, a lot of vehicles presently built by **Mercedes**, **Chrysler**, **BMW**, **Audi**, **VW**, **GM**, **Ford**, **Volvo**, and **Honda**, can be identified as wired completely or almost completely, at the end near the

Head and Park lights, similarly to the diagrams in CONFIGs A1 and B1. When simplified to one of these two diagrams with the 5 fuses F1, F2, F3, F4 and F5 next to each others as in these diagrams, the LightGenie, when plugged into the emptied fuse sockets of F1 to F5, would be given the absolute control on how to energize the Dome, Head and Park lights basing itself on the wishes of the users via the light switches, the state of the engine, the ambient light, and the Safety-Brake release. The LightGenie serving these first two groups will be similar to the one in FIG 1a. Finally, the third group includes many vehicles built with power relays in the Head and Park lights circuits in order for the low-current combination switch on the steering column to be usable by choice. A lot of vehicles presently made by **Chrysler**, **Ford**, **GM**, **Lexus**, **Toyota**, **Honda**, **Mitsubishi**, **Mazda**, **Subaru**, **Isuzu**, **Hyundai**, **and Kia** can be identified as wired more or less completely, at the end near the Head and Park lights, similarly to the diagram in CONFIG C1. This group may have to modify a few simple things to enjoy the high performance-to-cost ratio of the LightGenie: locate the Park-light relay (or Park-light fuse, so much the better if connected after the Park-light switch, like fuse F2 in CONFIG A or A1) and the Dome-light fuse in the same Relay and Fuse box containing the Head-light relay where applicable; and provide fuse F5 socket with Safety-Brake info. The LightGenie serving this group will be similar to Figs 2a or 3a. Fig. 3a also depicts the **fourth** variation of Universal LightGenie for vehicles that use a relay in the head lights to switch the power from the filaments to chassis ground, as encountered recently in Hyundai's Santa Fé.

Please refer to our photo PDFs on the website to see examples of the four variations of the LightGenie. The units pictured are pre-production models for U.S. OEM and aftermarket specifically made for each group of different platforms .

As an OEM interested in adopting the LightGenie to render your vehicles safer and more attractive to your customers, you can be assured that Dr. Tom Ricca, the inventor and principal developer of the LightGenie, will be there with your wiring architects and engineers to go through all aspects of technology, legal, human, and safety with utmost care, in order to arrive at the most desirable solution to your automotive lighting problems. This consulting work will be there free for your asking, as long as you see a chance of gaining an edge over the competition with the LightGenie, which is now offered widely to every vehicle manufacturer in the world. You would be glad to know that the LightGenie has taken more than nine years of development, testing and refinement, using the most modern technologies, in order to be able to offer such an encompassing solution and still appear very friendly to your customers and extremely easy on your assembly and maintenance personnel. Yet it will come to you at a modestly low cost that no other solution, classically simple or unnecessarily complicated, could offer at the present time.

The LightGenie is proven to be one thing: a ***great enhancer*** to the wiring safety of the vehicle. At OEM's choice, the warranty shall replace any LightGenie going defective by itself, **limited to the lifetime of the vehicle** on which it is attached or up to **10 years**, to be determined by OEM. For an out-of-warranty unit, the projected cost of replacing it with a new LightGenie is about 1/3 the total cost of repairing just a single defective light sensor on a Cadillac or Lexus at the present time.

What was just said about the LightGenie's capabilities sounded incredible to some and magic to others involved with state-of-the-art computers and electronics. But, anything resulting from those feelings about the LightGenie can be shown and explained to you clearly in a demonstration at your site. You will see then, the LightGenie is simply the product of a flash of luck, good listening, advanced engineering, and a lot of hard work. The LightGenie's magic will happen to your vehicles when you adopt it, raising the art of automotive lighting to a higher plateau. In the process, you will help **all** your customers to personalize extra safety, driving pleasure, and security of mind according to their taste and convictions, or need of the time.

• **Sample/Demo/Price/Availability:**

Owing to the unprecedented way the LightGenie is ***instantly*** installable on a new vehicle ***without cutting a single wire, splicing a wire to anything, or drilling a single hole,*** only LightGenies on vehicles for Canada need to be ordered on a just-in-time basis. LightGenies for new vehicles to be sold in the U.S. may be ordered on a per-demand basis at the dealerships. The demand is created by the instant availability of a factory-approved LightGenie at the last minute before a new vehicle is purchased. The buyer's decision is facilitated by the LightGenie's openly-known low price, high-value performance, and safety-enhancing features.

To make it more profitable for the OEMs, the LightGenie may be ordered without the following hardware components, when not necessary, in order to further reduce proportionately the unit cost:

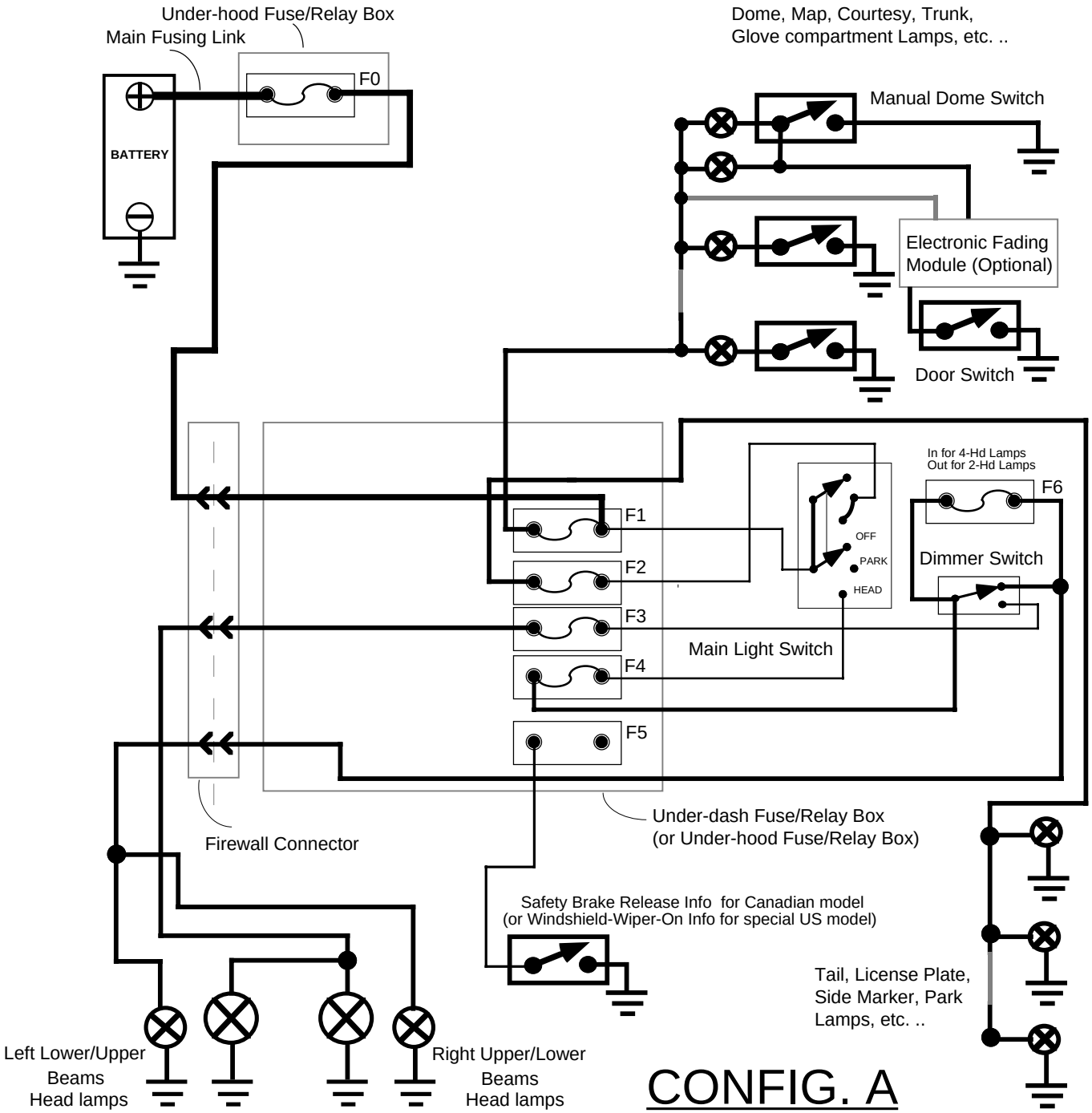
- Safety-Brake input (needed only for Canadian models);
- Head-and-Tail-Light-Flashing input;
- Windshield-Wipers-On input;
- Dome Light Control input/ output (not needed for vehicles already built with GEM or some form of battery saver).

For quick and thorough site demonstrations and pre-production LightGenie samples for potential OEMs, call or write to:

Innovanics, Inc.
1413 Wyandotte Rd.
Columbus, OH 43212

Tel: 614-488-8984 Fax: 614-488-0687
Email: tlricca@lightgenie.biz

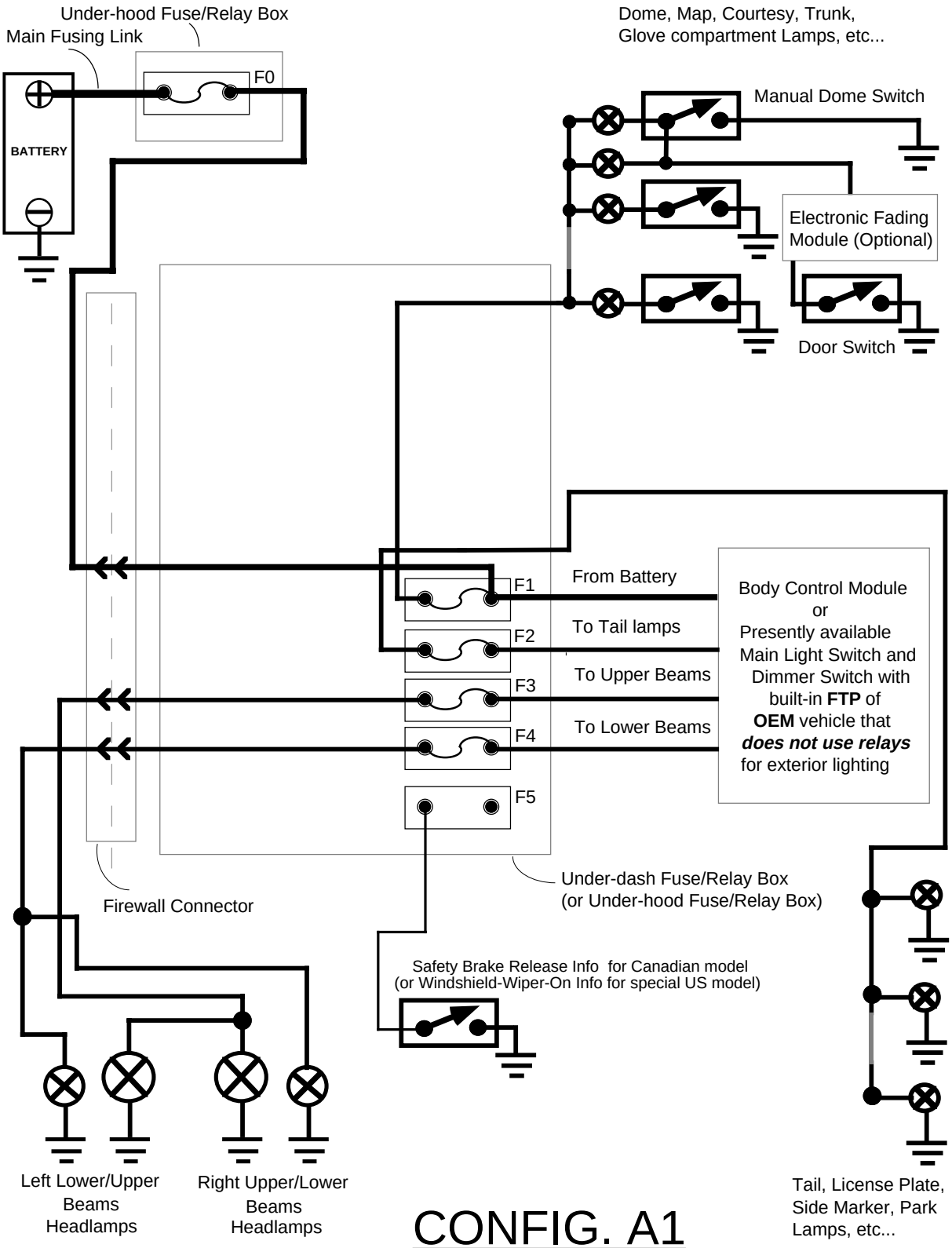
For the latest details, visit our website:
http://www.lightgenie.biz



Simplest and yet very safe suggested OEM vehicle wiring for major benefits of the **Universal LightGenie** in full compliance with traffic regulations anywhere in the world, by virtue of the **LightGenie**'s flexible firmware. User benefits include (where permitted by regulations):

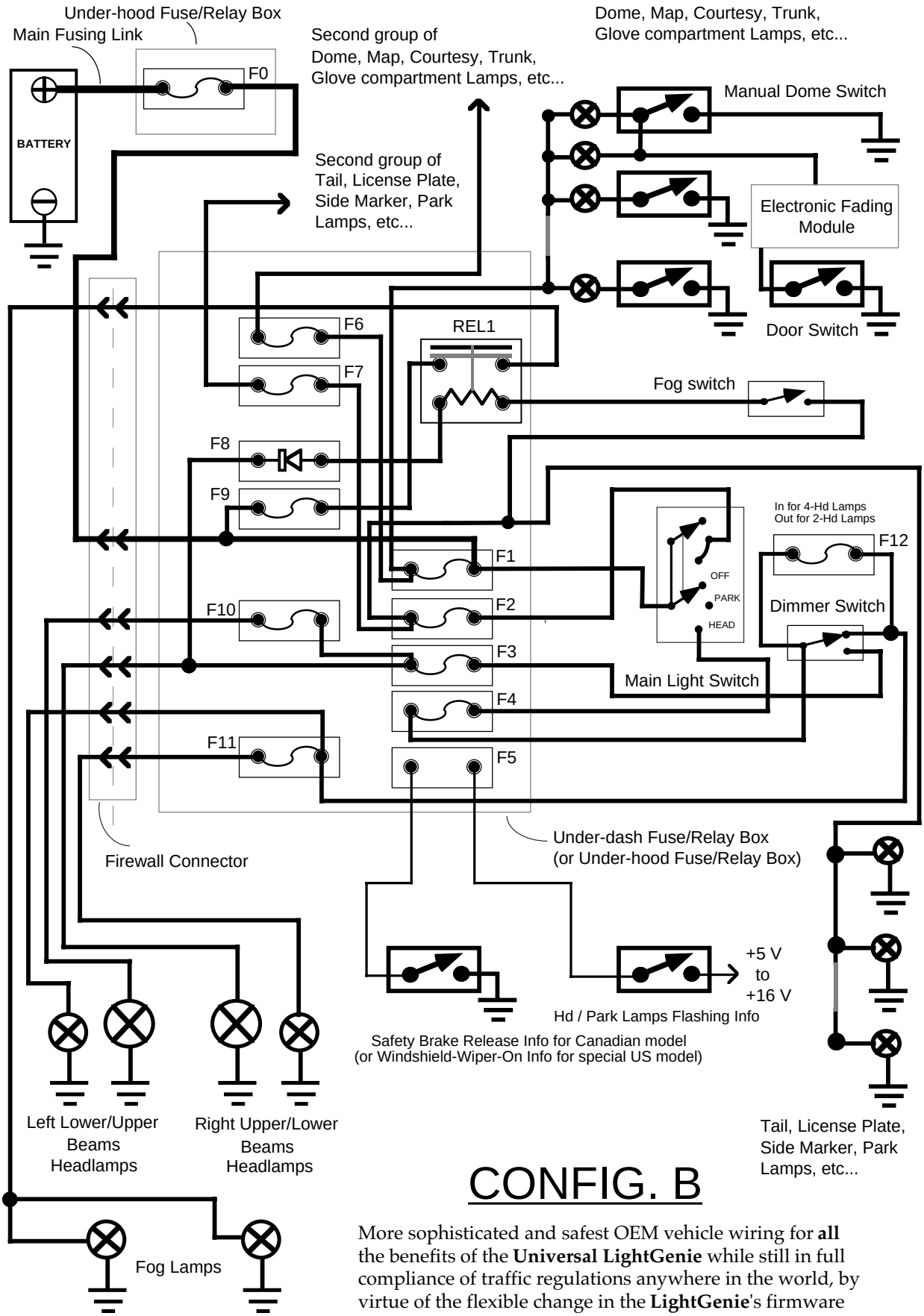
- Automatic Night-time Light Turn-on, with selectable Delay Turn-off
- Automatic HiB DRLs or LoB DRLs, with optional Rain-time Running Lights
- Intuitive manual turn-on and automatic delay turn-off of any light,without the need of an ignition key
- User's freedom to turn off all exterior lights any time; and to activate/deactivate DRL in a semi-permanent manner in 5 seconds without any tools (U.S. models)
- Bonus FTP in any main light switch position, even when DRLs are deactivated; in daytime, it turns to DRLs when the dimmer switch is latched in the Hight Beams position longer than 2 seconds
- Full battery protection when any Head, Park, or Dome lights are left on inadvertently
- 4-minute Head and Park manual turn-on and 4-hour Parking Lights, with automatic turn-off

This Configuration allows the OEM to produce LightGenie-ready vehicles with either 4-Headlamp or 2-Headlamp models to be sold without the LightGenie, giving dealerships more options/benefits to sell on delivery.



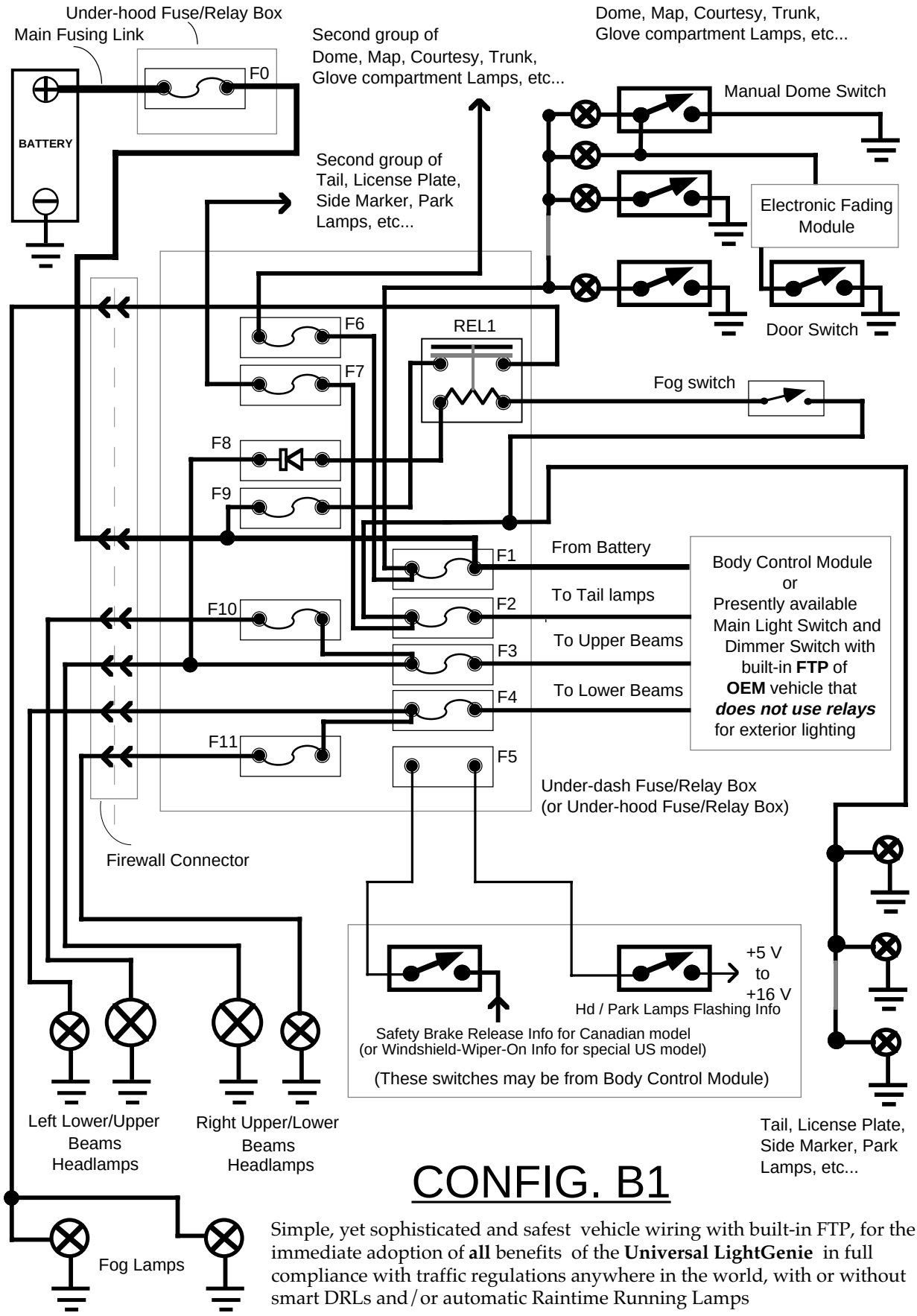
CONFIG. A1

Simplest and yet very safe **OEM** vehicle wiring with built-in FTP, for the immediate adoption of major benefits of the **Universal LightGenie** in full compliance with traffic regulations anywhere in the world, with or without smart DRLs and/or automatic Raintime Running Lamps



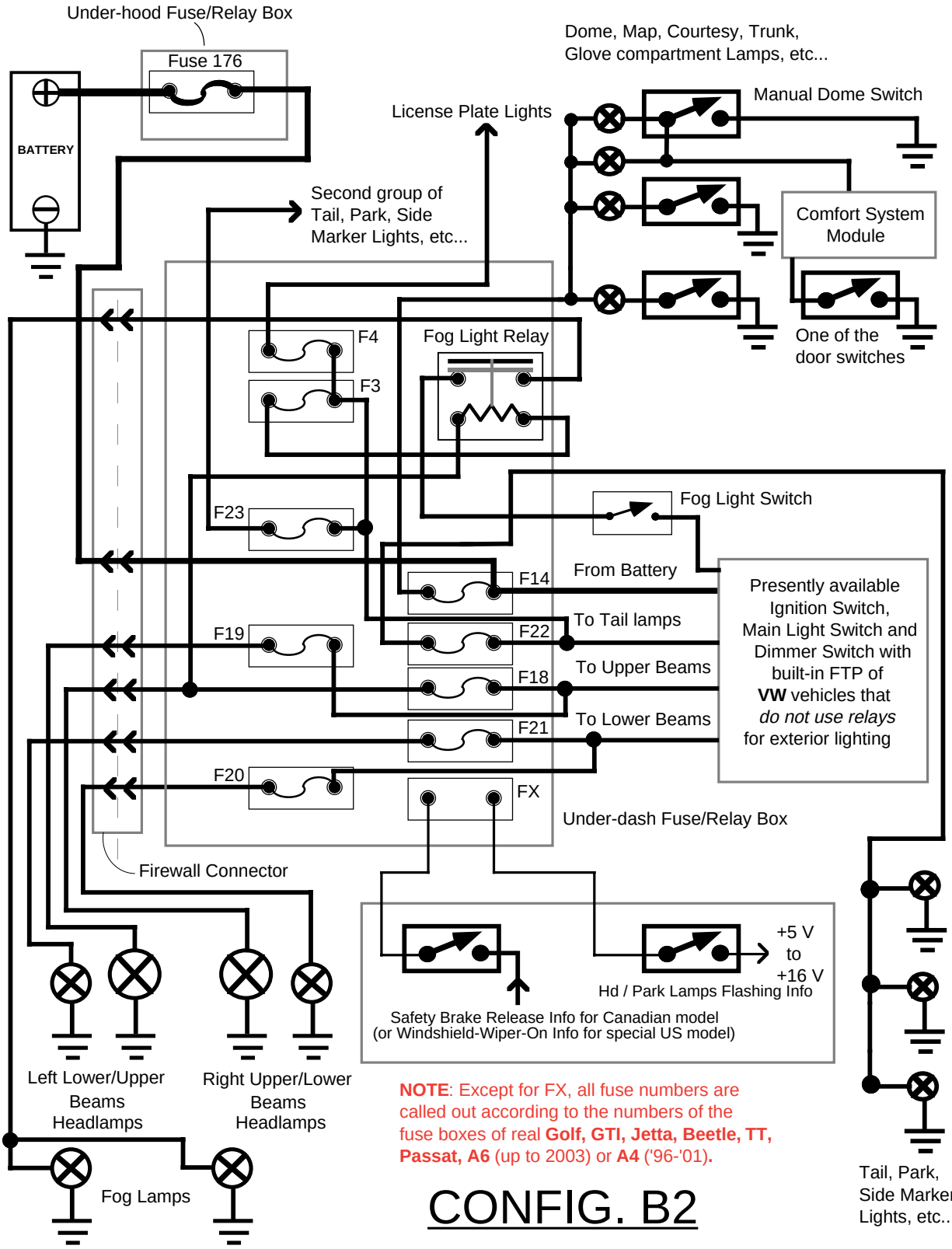
CONFIG. B

More sophisticated and safest OEM vehicle wiring for **all** the benefits of the **Universal LightGenie** while still in full compliance of traffic regulations anywhere in the world, by virtue of the flexible change in the **LightGenie**'s firmware

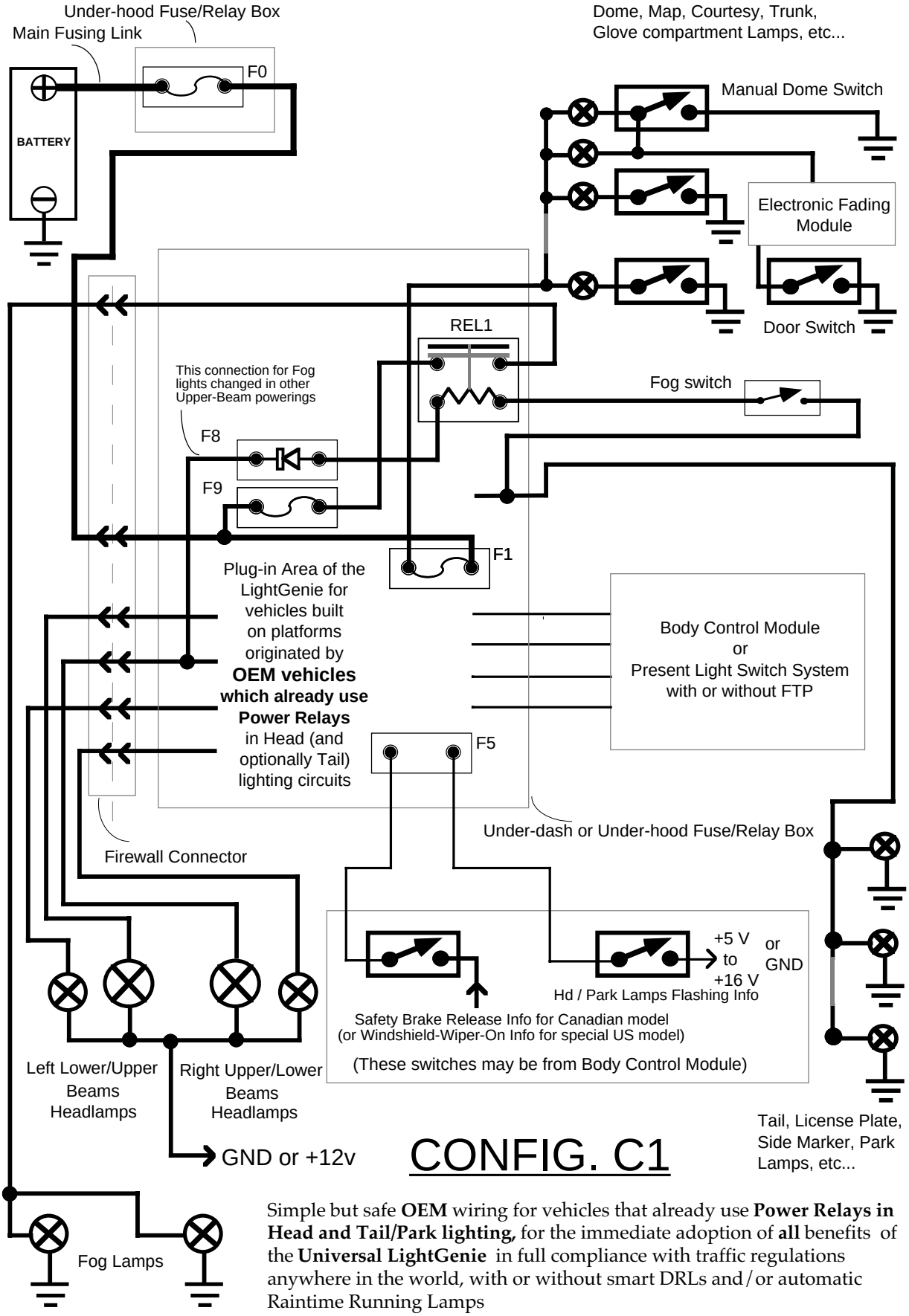


CONFIG. B1

Simple, yet sophisticated and safest vehicle wiring with built-in FTP, for the immediate adoption of **all** benefits of the **Universal LightGenie** in full compliance with traffic regulations anywhere in the world, with or without smart DRLs and/or automatic Raintime Running Lamps



Although not ideal for lowest cost, present no-change wiring of **Golf, GTI, Jetta, Beetle** or **TT** (up to '03) can immediately have **all** benefits of the **LightGenie** in full compliance with new-car traffic regulations anywhere in the world, with smart DRLs and with or without Raintime Running Lights. The installation of the U.S. LightGenie removes fuses F3, F4, F14, F18, F19, F20, F21, F22 and F23 and plugs into the emptied fuse sockets two multi-pronged plugs from the LightGenie, after the bracket and the ground line of the LightGenie were connected, and the light sensor was positioned in the gap between the left side of the instrumentation panel and body of the car, (see **Figure B2a**). The Canadian LightGenie requires no change in present VW wiring by having a wire with two tabs going into two receptacles of the emptied socket of the 'Daytime Running Light Change-over Relay'.



CONFIG. C1

Simple but safe **OEM** wiring for vehicles that already use **Power Relays in Head and Tail/Park lighting,** for the immediate adoption of **all** benefits of the **Universal LightGenie** in full compliance with traffic regulations anywhere in the world, with or without smart DRLs and/or automatic Raintime Running Lamps